इंटरनेट मानक

Disclosure to Promote the Right To Information

Whereas the Parliament of India has set out to provide a practical regime of right to information for citizens to secure access to information under the control of public authorities, in order to promote transparency and accountability in the working of every public authority, and whereas the attached publication of the Bureau of Indian Standards is of particular interest to the public, particularly disadvantaged communities and those engaged in the pursuit of education and knowledge, the attached public safety standard is made available to promote the timely dissemination of this information in an accurate manner to the public.

"जानने का अधिकार, जीने का अधिकार"
Mazdoor Kisan Shakti Sangathan
"The Right to Information, The Right to Live"

"पुराने को छोड नये के तरफ"
Jawaharlal Nehru
"Step Out From the Old to the New"

IS 14521 (1998): PVC Insulated Ribbon Cable with a Pitch of 1.27 mm Suitable for Insulation Displacement Termination [LITD 6: Wires, Cables, Waveguides and Accessories]

"ज्ञान से एक नये भारत का निर्माण"
Satyanarayan Gangaram Pitroda
"Invent a New India Using Knowledge"

Act Number 22 of 2005
The Indian Parliament
RIGHT TO INFORMATION

Made Available By
Public.Resource.Org

"ज्ञान एक ऐसा खजाना है जो कभी चुराया नहीं जा सकता है"
Bhartṛhari—Nītiśatakam
"Knowledge is such a treasure which cannot be stolen"

BLANK PAGE

BRUTUM FULMEN

IGNORANTIA JURIS NON EXCUSAT

PROTECTED BY COPYRIGHT

REAFFIRMED 2003

IS 14521 : 1998
IEC 918 (1987)

भारतीय मानक

विद्युत रोधन विस्थापन अन्तक भार के लिये उपयुक्त 1.27 मिलीमीटर की पिच वाला पी वी सी रोधित रिबन केबल

Indian Standard

PVC INSULATED RIBBON CABLE WITH A PITCH OF 1.27 mm SUITABLE FOR INSULATION DISPLACEMENT TERMINATION

ICS 29.060.20; 29.080.99

© BIS 1998

BUREAU OF INDIAN STANDARDS
MANAK BHAVAN, 9 BAHADUR SHAH ZAFAR MARG
NEW DELHI 110002

December 1998 **Price Group 7**

Wires, Cables, Waveguides and Accessories Sectional Committee, LTD 18

NATIONAL FOREWORD

This Indian Standard which is identical with IEC 918 (1987) 'PVC insulated ribbon cable with a pitch of 1.27 mm suitable for insulation displacement termination' and Amendment No. 1 to IEC 918 (1987), issued by the International Electrotechnical Commission (IEC), was adopted by the Bureau of Indian Standards on the recommendation of the Wires, Cables, Waveguides and Accessories Sectional Committee and approval of the Electronics and Telecommunication Division Council.

The text of the IEC standard has been approved as suitable for publication as Indian Standard without deviations. Certain conventions are, however, not identical to those used in Indian Standards. Attention is particularly drawn to the following:

a) Wherever the words 'International Standard' appear referring to this standard, they should be read as 'Indian Standard'.

b) Comma (,) has been used as a decimal marker while in Indian Standards, the current practice is to use a point (.) as the decimal marker.

Amendment 1 to the above International Standard has been printed at the end.

CROSS REFERENCES

In this Indian Standard, the following International Standards are referred to. Read in their respective places, the following:

International Standard	*Corresponding Indian Standard*	*Degree of Equivalence*
IEC 189-1 (1986) Low-frequency cables and wires with PVC insulation and PVC sheath, Part 1 General test and measuring methods	IS 5608 (Part 1) : 1991 LF wires and cables with PVC insulation and PVC sheath : Part 1 General requirements, test and measuring methods	Technically Equivalent
IEC 304 (1982) Standard colours for insulation for low-frequency cables and wires	IS 9938 : 1981 Recommended colours for PVC insulation for LF wires and cables	do
IEC 344 (1980) Guide to the calculation of resistance of plain and coated copper conductors of low-frequency cables and wires	IS 9941 : 1981 Guide to calculation of resistance of plain and tinned copper conductor of low-frequency cables and wires	do

The concerned technical committee has reviewed the provisions of following standards referred in this adopted standard and has decided that these are acceptable for use in conjunction with this standard:

IEC 28 (1925) International standard of resistance for copper

IEC 332-1 (1979) Tests on electric cables under fire conditions, Part 1 : Test on single vertical insulated wire or cable

IEC 811-1-2 (1985) Common test methods for insulating and sheathing materials of electric cables, Part 1: Methods for general application, Section 2 : Thermal ageing methods

IEC 811-3-2 (1985) Common test methods for insulating and sheathing materials of electric cables, Part 3 : Methods specific to PVC compounds, Section 2 — Loss of mass test — Thermal stability test

Only the English language text in the International Standard has been retained while adopting it in this Indian Standard.

AMENDMENT NO. 1

Page 4

5.1 *Solid conductor*

Delete "plain" from the first sentence.

5.4 *Tear propagation of the locating groove*

At the end of the first paragraph, change "20 N" to "10 N".

5.5 *Resistance to perforation*

Replace the title and text of this sub-clause by the following:

5.5 *Insulation material hardness*

The insulation shall be of a hardness which will permit a satisfactory connection by the ID method of termination. The hardness of the material shall be determined on a plaque moulded from granules and measured in accordance with ISO 868: Plastics and ebonite - Determination of indentation hardness by means of a durometer (Shore hardness).

The maximum hardness after 15 s shall not exceed 89 by the type A Shore durometer method. A measurement tolerance of ± 3 shall be allowed.

NOTE - Consideration may be given to use harder PVC with a limited number of conductors (for example hardness up to 100 with a limited number of 20 conductors).

Page 8

Appendix E – Thermal shock

In the first sentence of this appendix, replace "to five" by "within 1 h to a test consisting of five".

Page 9

Appendix K – Resistance to perforation

Delete this appendix.

Indian Standard

PVC INSULATED RIBBON CABLE WITH A PITCH OF 1.27 mm SUITABLE FOR INSULATION DISPLACEMENT TERMINATION

1. Scope

This standard is applicable to PVC insulated ribbon cable with a pitch of 1.27 mm and with a maximum of 64 conductors suitable for the insulation displacement (ID) method of termination.

The cable is regarded as suitable for continuous operation at conductor temperatures from − 10 °C to 90 °C. Alternatively the cable may be used at higher temperatures not exceeding 105 °C for periods to be agreed between the customer and manufacturer.

2. Object

The object of this standard is to specify requirements and dimensions for flexible, flat, unscreened, PVC insulated cables, with either solid or stranded conductors. The cables are suitable for operation in equipment at voltages up to and including 300 V r.m.s. to earth, or between cores. Cables covered by this standard can be terminated using the ID method of termination and are used for internal wiring in equipment.

Whilst the cable is still constrained on the drum for transportation purposes, temperatures down to − 55 °C can be tolerated. The cable shall have stabilized at a temperature of at least 15 °C before handling is undertaken.

3. General

It is the responsibility of the manufacturer to establish quality assurance by quality control procedures which will ensure that the product will meet the requirements of this standard. It is not intended that a complete testing programme shall be carried out on every length of conductor and cable. When the purchaser wishes to specify acceptance tests or other quality procedures, it is essential that agreement be reached between the purchaser and the manufacturer by the time of ordering.

4. Cable construction

4.1 *Conductor*

4.1.1 The conductor shall consist of annealed copper, uniform in quality and free from defects. The properties of the copper shall be in accordance with IEC Publication 28.

4.1.2 *Type of conductor*

The conductor may be either solid or stranded.

The solid conductor shall consist of a single strand of circular cross-section.

The stranded conductor shall consist of 7 or 19 strands of circular cross-section assembled in concentric formation and without insulation inclusions. The length of lay shall not exceed 20 times the overall diameter of the stranded conductor.

4.1.3 *Conductor finish*

The solid conductor shall be plain or tinned.

The stranded conductor shall be tinned.

An overall coating of tin may be applied to the tinned stranded conductor, but it shall not be of a thickness that allows the strands to be fused together.

Tinned conductors shall meet the requirements for easy soldering specified in Sub-clause 4.7 of IEC Publication 189-1.

4.1.4 *Conductor dimensions*

The solid conductor is designated by its nominal diameter. The stranded conductor is designated by its nominal cross-sectional area, the number of strands and nominal diameter of strands.

Dimensions are given in Table I.

TABLE I

Number of strands	Nominal diameter of strands (mm)	Nominal sectional area (mm²)	Maximum conductor resistance at 20 °C (Ω/km)
1	0.25		379
7	0.10	0.05	365
1	0.32		225
7	0.13	0.09	216*
19	0.08	0.10	210
1	0.4		144
7	0.16	0.14	136
7	0.20	0.22	87.2

* Based on a diameter of 0.127 mm.

4.1.5 *Continuity of conductor*

Joints in solid and complete stranded conductors are not permitted. Joints in individual strands of the stranded conductor are permitted provided that they are spaced at least 0.3 m apart in the stranded conductor.

4.2 *Insulation*

4.2.1 *Insulation material*

The insulation shall consist of polyvinyl chloride (PVC) compound with properties chosen to meet the requirements of this standard.

4.2.2 *Insulation thickness*

The insulation shall be continuous, having a thickness such that the complete cable shall have the dimensions and the conductor pitch given in Figures 1 and 2, and in Table II.

The minimum thickness of insulation shall be 0.18 mm.

The insulation shall also meet the requirements of Sub-clause 4.3 of this standard.

Table II

Preferred number of conductors	Dimension l_1 (mm)		Dimension l_2 (mm)	
6	7.62	±0.25	6.35	±0.18
9	11.43		10.16	
10	12.70		11.43	
12	15.24		13.97	
14	17.78		16.51	
15	19.05		17.78	
16	20.32	±0.4	19.05	±0.28
20	25.40		24.13	
24	30.48		29.21	
25	31.75		30.48	
26	33.02		31.75	
29	36.83		35.56	
30	38.10	±0.5	36.83	±0.38
34	43.18		41.91	
36	45.72		44.45	
37	46.99		45.72	
40	50.80		49.53	
44	55.88		54.61	
50	63.50		62.23	
60	76.20		74.93	
64	81.28		80.01	

See Figures 1 and 2 for dimensions l_1 and l_2. In order to ensure correct mating with connectors it is necessary to control the accumulation of the individual pitch tolerances within a cable as follows:

for any group of up to 15 conductors:	±0.18 mm;
for any group of 16 to 29 conductors:	±0.28 mm;
for any group of 30 to 64 conductors:	±0.38 mm.

.2.3 *Colour of insulation*

Ribbon cable with the configuration shown in Figures 1 and 2 shall have each wire coloured by a separate colour.

The preferred colour code is given in Appendix A.

Where required, the complete assembly shall be coloured by a single base colour.

The preferred colour for the base shall be grey. Cable with a single base colour shall be marked to indicate face orientation.

Colours shall be readily identifiable and correspond reasonably with standard colours shown in IEC Publication 304.

.3 *Construction*

.3.1 The PVC insulation shall be applied by extrusion or lamination to non-insulated conductors to form a cable with conductors laid parallel having pitch as specified in Figure 1. The insulation shall be provided with a location groove on both sides between conductors. The thickness of insulation between two opposing grooves shall have a minimum value of 0.1 mm.

The position of the minimum thickness at the bottom of a groove shall not be less than 0.5 mm from the centre of the nearest conductor. In no case shall the depth of the groove be less than 0.24 mm. The ratio of minimum insulation thickness to maximum insulation thickness on any diameter passing through the centre line of the conductor and through the surface of the cable between locating grooves shall not be less than 0.65.

4.3.2 Alternatively, individual PVC insulated conductors shall be laid parallel to form a flat ribbon by bonding to a film and being held in relative position, with the conductor pitch as specified in Figure 2.

The minimum insulation thickness of the individually insulated conductor shall be 0.18 mm and the ratio of minimum to maximum insulation thickness shall not be less than 0.65.

5. Mechanical requirements

5.1 *Solid conductor*

Elongation at break of the plain solid conductor shall be not less than 10%. Compliance shall be checked before and after accelerated ageing by measuring the elongation at break in accordance with the method specified in Sub-clause 3.3 of IEC Publication 189-1.

5.2 *Insulation*

The insulation shall have adequate mechanical strength and elasticity.

Compliance shall be checked before and after accelerated ageing by measuring the tensile strength and the elongation at break on samples of the insulation in accordance with Sub-clause 3.3 of IEC Publication 189-1.

Test pieces shall be provided by stripping an insulated conductor from the cable and removing the conductor to provide tubular test pieces.

The median of the measured values of tensile strength shall be not less than 12.5 N/mm^2 (MPa).

The median of the measured values of elongation at break shall be not less than 125%.

Samples of insulation shall be subjected to an accelerated ageing test in accordance with Sub-clauses 8.1.2 and 8.1.3 of IEC Publication 811-1-2.

The test pieces shall be kept in the oven at 135 ± 2 °C for 7 × 24 h.

The difference between the median values for tensile strength and elongation obtained before and after accelerated ageing shall not exceed 25% of the median values before ageing.

5.3 *Folding*

The insulation shall be sufficiently pliable to withstand folding of the cable.

Compliance shall be checked in accordance with the test specified in Appendix B.

There shall be no evidence of cracking, delamination, fracturing or rupturing of the insulated conductor or bonding material.

5.4 *Tear propagation of the locating groove*

The dimensions of the locating grooves shall allow separation of the insulated conductors of the cable after reasonable force is applied. Compliance shall be checked in accordance with the test specified in Appendix C. The minimum force recorded shall not be less than 1 N and the maximum force recorded shall not exceed 20 N.

There shall be no propagation of the tear to an adjacent conductor, and after tearing the cable shall be capable of passing the dielectric strength test of Appendix J.

5.5 *Resistance to perforation*

The insulation shall be of a robustness which will permit a satisfactory connection by the ID method of termination.

Compliance shall be checked in accordance with the test specified in Appendix K (under consideration).

5.6 *Delivery*

The cable shall be wound on adequate reels or spools with a minimum barrel diameter of 70 mm.

In order to minimize damage, during transportation and storage, it is recommended that the flanges of the reels and spools should be put in a vertical position.

6. **Thermal stability requirements**

6.1 *Flexing test* (stranded conductor only)

The insulation shall remain adequately pliable throughout the range of temperatures to which it may be exposed in normal use.

Compliance shall be checked on stranded conductor in accordance with the test specified in Appendix D. The test specimens shall exhibit no conductor breaks or cracking of the insulation, or delamination or cracking of the bonding material.

6.2 *Thermal shock*

The insulation shall withstand variations in temperature without cracking and without evidence of delamination or visible change in the bonding material.

Compliance shall be checked in accordance with the test specified in Appendix E.

The shrinkage of insulation at either end shall be not more than 3 mm.

6.3 *Flame test*

The resistance to flame propagation shall be in accordance with IEC Publication 332-1.

The compliance shall be checked in accordance with the method specified except that the source of heat shall be a single gas burner applied to one edge of the ribbon cable positioned with its face in the same vertical plane as the axis of the burner tube.

6.4 *Loss of mass of insulation after ageing*

The median of the measured values of the loss of mass of the insulation shall not exceed 20 g/m^2. Compliance shall be checked in accordance with the test specified in Appendix F.

6.5 *Dimensional stability after storage*

The cable shall retain dimensional stability during storage. Compliance shall be checked in accordance with the test specified in Appendix G.

7. **Electrical requirements**

7.1 *Electrical resistance of conductor*

The electrical resistance of the conductor measured at a temperature of 20 °C shall not exceed the values given in Table I.

Calculation of these values is based on IEC Publication 344 using the value of k_1 for tinned conductors and k_2 for stranded conductors. Plain solid conductors shall be calculated as tinned for the purpose of this standard.

The method of measuring resistance and also for correcting the measured values of length and temperature are specified in Sub-clause 5.1 of IEC Publication 189-1.

7.2 *Spark test*

A spark test shall be carried out on the total length of the cable using double brush or double roller electrodes. A potential of at least 2.5 kV r.m.s. shall be applied for not less than 0.2 s.

There shall be no failure.

7.3 *Insulation resistance*

The insulation resistance measured at a temperature of 20 ± 5 °C shall be not less than 50 MΩ · km.

Compliance shall be checked in accordance with the test specified in Appendix H.

7.4 *Dielectric strength*

The insulation shall withstand the application for 1 min without breakdown, of 2 000 V r.m.s. or 3 000 V d.c.

Compliance shall be checked in accordance with the test specified in Appendix J.

APPENDIX A

COLOUR CODE FOR INSULATION (Sub-clause 4.2.3)

Number of conductors (counting from the edge)							Colour of insulation
1	11	21	31	41	51	61	Brown
2	12	22	32	42	52	62	Red
3	13	23	33-	43	53	63	Orange
4	14	24	34	44	54	64	Yellow
5	15	25	35	45	55	—	Green
6	16	26	36	46	56	—	Blue
7	17	27	37	47	57	—	Violet
8	18	28	38	48	58	—	Grey
9	19	29	39	49	59	—	White
10	20	30	40	50	60	—	Black

APPENDIX B

FOLDING TEST (Sub-clause 5.3)

A sample of cable of 1 m minimum length shall be conditioned for 1 h at 20 ± 5 °C. The test specimen shall be folded 180° transversely (Figure 3) and pressed between two smooth flat metal plates under a load of 135 ± 5 N per 25 mm width of cable. After 15 ± 1 min under pressure, the test sample shall be unfolded and the pressure re-applied to the unfolded creased portion for an additional 15 ± 1 min.

This procedure constitutes one complete cycle.

After two complete cycles of folding and unfolding on the same creased portion, the cable shall be examined with normal or corrected vision without magnification.

The test shall be conducted at 20 ± 5 °C.

The test specimen shall be subjected to the dielectric strength test specified in Appendix J. The continuity of each conductor shall be checked.

APPENDIX C

TEAR PROPAGATION OF THE LOCATING GROOVE (Sub-clause 5.4)

A sample of cable of 150 mm minimum length shall be conditioned for 1 h at 20 ± 5 °C and the test specimen shall be split for a distance of 50 ± 5 mm along a locating groove. A split end shall be mounted in each jaw of a tensile test machine as shown in Figure 4. The force between the jaws shall be increased until the tear has been propagated up to 50 ± 5 mm using a jaw separation rate of 300 ± 50 mm/min. The force applied to the jaws shall be monitored as a chart recording. The test shall be conducted at a temperature of 20 ± 5 °C.

APPENDIX D

FLEXING TEST (Sub-clause 6.1)

A sample of cable of minimum length 200 mm shall be suspended from two parallel jaws under a loading of 0.25 N per conductor as shown in Figure 5. The lower edges of the jaws shall be radiused to 3 mm. The jaws shall be adjusted so that the lower edge of the jaws is coincident with the axis of rotation of the flexing apparatus and also that the parallel faces are vertical. The jaws shall be rotated so that the ribbon cable is flexed along a line at right angles to the conductors to + 90°, is returned through the origin to −90° and is then returned to the starting position. This shall constitute one cycle. The test shall be repeated for 20 cycles without breakage of the conductors or damage to the insulation. The rate of cycling shall be 10 ± 5 cycles/min. The test shall be conducted at −10 ± 1 °C after conditioning for 1 h at −10 ± 1 °C. The test pieces shall be examined with normal or corrected vision without magnification.

APPENDIX E

THERMAL SHOCK (Sub-clause 6.2)

A sample of cable approximately 1 000 mm long and wound into a loose coil of approximately 100 mm diameter shall be subjected to five continuous cycles of high and low temperature, the sample being maintained at each temperature extreme for 30 min, with a maximum of 2 min allowed for transfer between the test chambers. The temperature of the test chambers shall be −10 ± 1 °C and 105 ± 3 °C.

After completion of the five cycles, the sample shall be removed from the test chamber and allowed to stabilize at 20 ± 5 °C. The sample shall then be examined with normal or corrected vision without magnification.

APPENDIX F

LOSS OF MASS OF INSULATION (Sub-clause 6.4)

The loss of mass after ageing shall be checked in accordance with the method specified for tubular test pieces in Sub-clause 8.1 of IEC Publication 811-3-2 except that a temperature of 135 ± 2 °C shall be applied for 7 × 24 h.

The test specimens shall be provided by stripping an insulated conductor from the cable and removing the conductor to provide three tubular test pieces.

APPENDIX G

DIMENSIONAL STABILITY AFTER STORAGE (Sub-clause 6.5)

A cable sample about 300 mm long shall be placed flat on a horizontal low friction surface and held at −55 ± 5 °C for 4 h, after which the sample shall be returned to 20 ± 5 °C for at least 16 h. The sample shall then be placed into an air oven preheated to 55 ± 3 °C for 4 h and then returned to 20 ± 5 °C for at least 16 h.

The sample shall be measured to check compliance with the dimensional tolerances specified in this standard.

APPENDIX H

INSULATION RESISTANCE (Sub-clause 7.3)

A sample of not less than 600 mm shall be taken. The uninsulated ends shall be connected to a negative d.c. terminal and the cable immersed to within 150 mm of its ends for not less than 4 h in water at 20 ± 5 °C. After this a direct voltage of 500 ± 50 V shall be applied for 1 min between each conductor and the water, and between adjacent conductors.

The increase of insulation resistance shall be uniform throughout the 1 min electrification.

APPENDIX J

DIELECTRIC STRENGTH (Sub-clause 7.4)

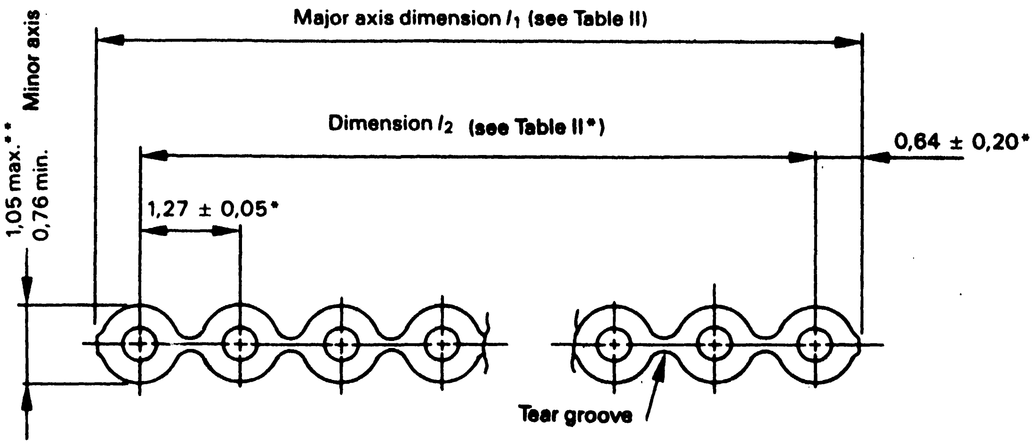
This test may be performed immediately after the insulation resistance test using the same sample. When the test is performed on a separate sample, it shall be at least 600 mm in length. Not less than 300 mm of cable shall be immersed for at least 4 h in water at 20 ± 5 °C with 150 mm at each end left out.

The test specimen shall withstand 2 000 V r.m.s. or 3 000 V d.c. applied between conductors and water and between adjacent conductors. The voltage shall be increased gradually and maintained at its full value for 1 min.

APPENDIX K

RESISTANCE TO PERFORATION

Under consideration.

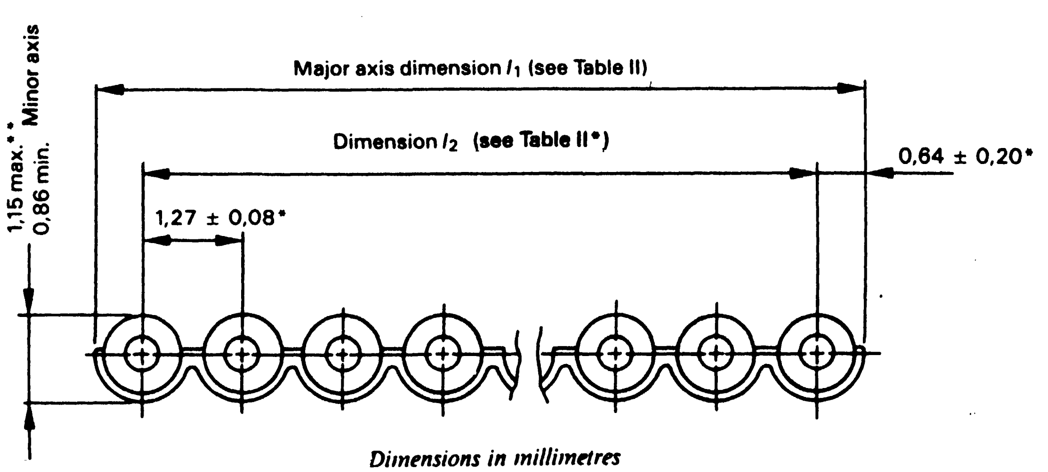

Major axis dimension l_1 (see Table II)
Dimension l_2 (see Table II*)
0,64 ± 0,20*
1,27 ± 0,05*
1,05 max.**
0,76 min.
Minor axis
Tear groove

Dimensions in millimetres

* Dimensions referred to conductors are to be taken from the centre lines of the conductors.

** For 7/0.20 the maximum thickness shall be 1.15.

FIG. 1. — **Extruded or laminated construction.**


Major axis dimension l_1 (see Table II)
Dimension l_2 (see Table II*)
0,64 ± 0,20*
1,27 ± 0,08*
1,15 max.**
0,86 min.
Minor axis

Dimensions in millimetres

* Dimensions referred to conductors are to be taken from the centre lines of the conductors.

** For 7/0.20 the maximum thickness shall be 1.15.

Note. — The diagrams of Figures 1 and 2 are to illustrate the dimensional requirements and do not represent actual designs.

FIG. 2. — **Bonding upon flat ribbon construction.**

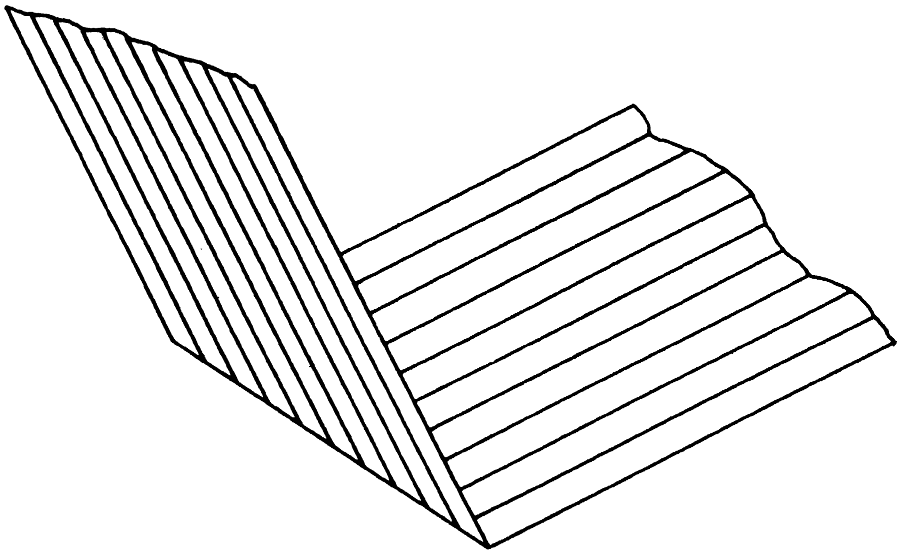


FIG. 3. — Folding test.

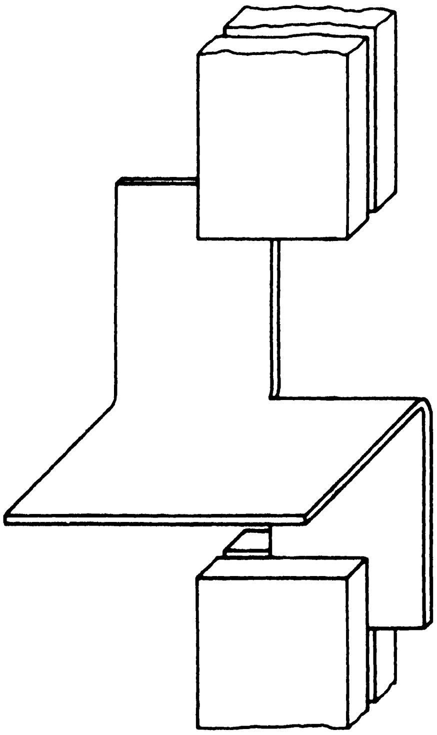


FIG. 4. — Tear propagation test arrangement.

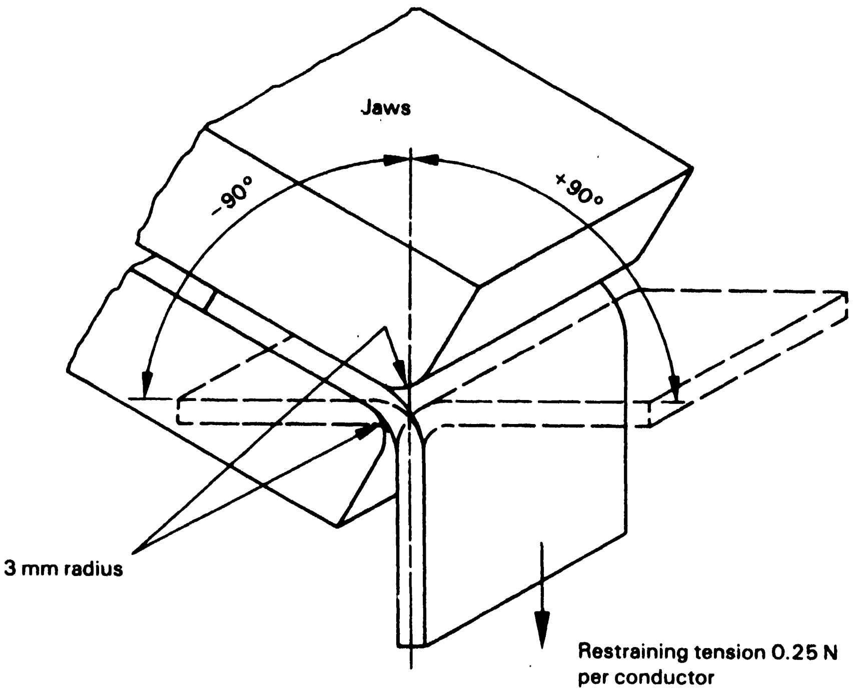


FIG. 5. — Flexing test arrangement.

AMENDMENT NO. 1

Page 4

5.1 *Solid conductor*

Delete "plain" from the first sentence.

5.4 *Tear propagation of the locating groove*

At the end of the first paragraph, change "20 N" to "10 N".

5.5 *Resistance to perforation*

Replace the title and text of this sub-clause by the following:

5.5 *Insulation material hardness*

The insulation shall be of a hardness which will permit a satisfactory connection by the ID method of termination. The hardness of the material shall be determined on a plaque moulded from granules and measured in accordance with ISO 868: Plastics and ebonite - Determination of indentation hardness by means of a durometer (Shore hardness).

The maximum hardness after 15 s shall not exceed 89 by the type A Shore durometer method. A measurement tolerance of ± 3 shall be allowed.

NOTE - Consideration may be given to use harder PVC with a limited number of conductors (for example hardness up to 100 with a limited number of 20 conductors).

Page 8

Appendix E – Thermal shock

In the first sentence of this appendix, replace "to five" by "within 1 h to a test consisting of five".

Page 9

Appendix K – Resistance to perforation

Delete this appendix.

Bureau of Indian Standards

BIS is a statutory institution established under the *Bureau of Indian Standards Act*, 1986 to promote harmonious development of the activities of standardization, marking and quality certification of goods and attending to connected matters in the country.

Copyright

BIS has the copyright of all its publications. No part of these publications may be reproduced in any form without the prior permission in writing of BIS. This does not preclude the free use, in the course of implementing the standard, of necessary details, such as symbols and sizes, type or grade designations. Enquiries relating to copyright be addressed to the Director (Publication), BIS.

Review of Indian Standards

Amendments are issued to standards as the need arises on the basis of comments. Standards are also reviewed periodically; a standard along with amendments is reaffirmed when such review indicates that no changes are needed; if the review indicates that changes are needed, it is taken up for revision. Users of Indian Standards should ascertain that they are in possession of the latest amendments or edition by referring to the latest issue of 'BIS Handbook' and 'Standards Monthly Additions'.

This Indian Standard has been developed from Doc: No. LTD 18 (1597).

Amendments Issued Since Publication

Amend No.	Date of Issue	Text Affected

BUREAU OF INDIAN STANDARDS

Headquarters:

Manak Bhavan, 9 Bahadur Shah Zafar Marg, New Delhi 110002
Telephones: 323 01 31, 323 33 75, 323 94 02

Telegrams: Manaksanstha
(Common to all offices)

Regional Offices:

Regional Offices:		Telephone
Central	: Manak Bhavan, 9 Bahadur Shah Zafar Marg NEW DELHI 110002	323 76 17, 323 38 41
Eastern	: 1/14 C.I.T. Scheme VII M, V.I.P. Road, Maniktola CALCUTTA 700054	337 84 99, 337 85 61 337 86 26, 337 91 20
Northern	: SCO 335-336, Sector 34-A, CHANDIGARH 160022	60 38 43 60 20 25
Southern	: C.I.T. Campus, IV Cross Road, CHENNAI 600113	235 02 16, 235 04 42 235 15 19, 235 23 15
Western	: Manakalaya, E9 MIDC, Marol, Andheri (East) MUMBAI 400093	832 92 95, 832 78 58 832 78 91, 832 78 92

Branches : AHMADABAD. BANGALORE. BHOPAL. BHUBANESHWAR. COIMBATORE. FARIDABAD. GHAZIABAD. GUWAHATI. HYDERABAD. JAIPUR. KANPUR. LUCKNOW. NAGPUR. PATNA. PUNE. THIRUVANANTHAPURAM.

Printed at Simco Printing Press, Delhi, India